# 5.0 ADDITIONAL GUIDANCE

## 5.1 Tracking and Assessing Progress

This section is about two functions that are necessary to ensure that society's actions are consistent with the restoration and protection of water quality. One function is the "tracking" of information. The second function is the "assessment" of that information. There are many intermediate tracking and assessment functions associated with routine activities like land development that typically focus on managing pollutant loads, which are linked by TMDL analyses to water quality impacts. Ultimately, water quality information must be tracked and assessed to determine progress in achieving regulatory standards.

Local jurisdictions implement a variety of activities that help to restore and protect water quality. Collectively, these activities represent TMDL implementation by different names. Perhaps it's called municipal stormwater management, or sensitive areas planning, or wetlands management, or forest conservation. Simply acknowledging and taking credit for this "TMDL implementation" by a different name is an essential first step toward tracking progress on achieving clean water.

The ability to document progress, particularly in regard to nonpoint source (NPS) pollution, has become a valuable technical asset. In addition to being able to account for progress on *reducing* excessive pollutant loads, similar assessment methods will be necessary to administer *offsets* of new sources of pollutants in the future. These same tracking and assessment capacities apply to *protecting* high-quality waters under Maryland's antidegradation policy.

Section 5.1.1 describes key tracking and assessment issues in general. It also highlights existing tracking and assessment frameworks and describes refinements that are anticipated in the near-term.

Section 5.1.2 goes into more depth. The material is organized by pollutant sources, in part because TMDLs must account for all pollutant sources, including natural sources.

Finally, Section 5.1.3 addresses water quality monitoring, which can be viewed as part of the assessment topic.

### 5.1.1 Overview of Key Tracking and Assessment Issues

Due to Maryland's long history of working to restore the Chesapeake Bay, many procedures have already been established to track the key restoration activities that address nutrients. These include agricultural best management practices, urban best management practices, a variety of natural resource management activities and point source discharges.

**Current tracking and reporting requirements under existing regulatory programs for local governments are generally sufficient for addressing present nutrient TMDL implementation needs.**

Stormwater management is of significant importance to local governments, and provides a relevant example. Routine procedures currently exist, in accordance with the Code of Maryland Regulations (COMAR) 26.17.02.09C, for each county or municipality to submit a notice of construction completion to MDE for each stormwater management practice.

Recently, a variety of natural resource practices associated with stream corridors have been recognized as having a quantifiable nutrient reduction value. These same practices will likely play a role in assessing progress with respect to TMDLs for biological impairments in non-tidal streams, which have yet to be developed. It is acknowledged in the "Stream Corridor" section below that tracking procedures for these activities need to be enhanced.

Taking a proactive view, although TMDLs for biological impairments have yet to be developed, we encourage local governments to continue investing in stream restoration initiatives as a priority.

**Local governments covered by NPDES stormwater permits should track stream restoration projects as part of their routine NPDES reporting process.**

Protection of healthy streams is also important.

**The "Maryland Stormwater Design Manual" provides a systematic framework for managing the potential impacts to the physical habitat of non-tidal streams based on the quantified assessment of impervious cover.**

Implementation activities related to other types of TMDLs are discussed in Section 5.1.2 In many cases, the tracking needs can build upon certain nonpoint source controls used to manage nutrients (e.g., sediment controls).

In addition, it is generally acknowledged that better information is desirable in the long run to reduce decision-making uncertainties. The subject of continued future refinements is discussed in Section 5.7 "Long-Range Capacity Building."

Although it should not affect local governments, certain State tracking procedures are undergoing enhancements. First, the Maryland Department of Environment is responsibile for consolidating the State's restoration tracking activities in support of the Chesapeake Bay Program nutrient management goals. This function, formerly performed by the Maryland Department of Natural Resources, will serve as the foundation for tracking progress on implementing nutrient TMDLs.

Second, Maryland is striving for consistent accounting procedures between localized nutrient TMDLs and the regional Chesapeake Bay Program nutrient goals. Because of the vastly different geographic scales at which these similar technical analyses have been conducted in the past, consistency gaps have been noted by local governments and acknowledged by the State (e.g., differences in estimates of urban loads). The adoption of a new Chesapeake Bay Program watershed model (Phase V) in about a year offers an opportunity to narrow that gap. Local governments with the technical capacity to participate in the development of that model are encouraged to do so over the coming years.

Third, Maryland is a regional partner in an initiative to begin using the National Environmental Information Exchange Network (NEIEN) as the means by which future BMP information will be transferred from the State to the EPA Chesapeake Bay Program. The enhanced automation of data transfer will motivate refinements that ensure Bay States use consistent BMP accounting protocols. The NEIEN initiative is not expected to affect the way local governments currently report information to the State.

Although this Guidance does not call for significant changes in local tracking and reporting of information to the State, local capacity to assess this existing information in support of enhanced water quality management decision-making will require attention. The specific policies, operational procedures and tools for such analyses are under development by the State. However, the Chesapeake Bay Program provides information to support 2006 analysis methods.

**The Chesapeake Bay Program provides a common framework for nutrient load assessments, which accounts for regional differences. The State recommends that this framework be considered by local governments seeking to estimate nutrient loads. (See Appendix E "Nonpoint Source Nutrient Loading Assessments Using Chesapeake Bay Program Land Use Loading Coefficients").**

This pollutant load assessment capacity will be helpful for conducting long-range land use planning. Also, MDE is in the process of exploring alternative technical and administrative procedures for offsetting the increase in nutrient loads from project-oriented land use changes. Maryland's Nutrient Cap Maintenance Strategy procedures for point sources will provide a key component of the framework. Local governments with an interest may play a role in the development of these procedures.

### 5.1.2 Tracking and Assessing Pollutant Sources and Control Practices

Local governments are not expected to have the expertise and capacity for maintaining an inventory of all pollutant sources. However, a basic understanding and evolving capacity in this regard will help local jurisdictions better determine their own destiny.

For example, a local jurisdiction that has the capacity to account for NPS pollutant loads might decide to set aside certain land in perpetuity to use for future spray irrigation of municipal wastewater. This would accommodate future growth that is consistent with TMDLs. By making use of public sewer systems it would avoid pollutant loads associated with septic systems. It would also promote efficient growth principles, thereby preserving the rural character of the surrounding countryside and help ensure the economic viability of local agriculture.

The remainder of this section provides an overview of key sources of pollutants. It identifies critical information to track, and relates that information to assessment needs for TMDL implementation.

#### 5.1.2.1 Natural Sources

The assimilative capacity of a waterbody for a given pollutant is generally independent of the particular sources of that pollutant. Thus, TMDL analyses must account for all pollutant sources including natural sources and atmospheric deposition.

It is important to be aware of natural sources. Natural sources are likely to be accounted for within the context of tracking nonpoint sources, such as tracking existing and re-established forestlands and wetlands. This is discussed further in the Section 5.1.2.4 below.

In some cases, natural sources are the main reason why a waterbody is violating a water quality criterion. For instance, some geological formations release high amounts of certain heavy metals. In some cases these formations generate sufficient natural loads to cause the violation of a water quality criterion. However, State standards include a "natural conditions" provision, which could be invoked when interpreting whether the exceedance of a numeric water quality criterion should actually constitute a violation of the standard.

Local expertise in identifying a natural geological source of pollution can be essential in such a situation.

**Simply being aware of existing natural sources of pollutants represents a basic, yet potentially vital, form of "tracking" by local governments. This concept of simply being aware of a pollutant source can apply to other source categories, and is an example of the kind of common sense that should be applied to this subject of "tracking."**

<u>Bacteria</u>: In the case of fecal bacteria, wildlife sources can make up a significant portion of the total load. In some cases, ecosystem imbalances in predator/prey relationships or invasive species can cause a population imbalance, which might warrant human intervention. In other cases the wildlife sources are completely natural. The subject of how to address wildlife sources of bacteria is an active area of national debate. This subject is beyond the scope of this Guidance; however, it is acknowledged that local expertise could play a role.

<u>Sediments</u>: Some degree of sediment transport is natural to the healthy function of non-tidal streams. Although the exception, streams that have been "starved" of external sources of sediment have been observed to suffer more stream channel erosion as the stream seeks a natural hydrologic balance. The natural amount of sediment erosion varies by geographic region. Methodologies for sediment TMDLs are still under development in Maryland, and are taking this variability of natural sources into account.

**Natural sources of pollutants must be accounted for when assessing progress on achieving TMDLs. It is in the interest of local governments to be involved in the on-going dialogue regarding natural sources of pollutants.**

#### 5.1.2.2 Point Sources

Traditionally, the term "point sources" was limited to describing concentrated discharges of wastewater, such as that from pipes (traditional point sources). On November 2002, the US EPA issued a refinement in their interpretation of the regulatory term "point source" to include any effluent that is managed under any type of NPDES permit (Wayland Memo, 11/22/02). This includes "regulated stormwater" managed under NPDES municipal separate storm sewer system (MS4) permits and permits for the eleven categories of industrial stormwater sources, which include construction activities.

Traditional Point Sources: The tracking and reporting of information for discharges from currently permitted traditional point sources are fairly well institutionalized within the NPDES permitting and compliance processes for most pollutants. Mechanisms for addressing special cases or operational details, such as aeration rates in the case of some BOD TMDLs, make use of the routine administrative and communications frameworks associated with the NPDES surface water discharge program. The standard operating procedures of the NPDES programs at MDE now include a consistency check for TMDLs.

A relatively small number of plants discharge upstream of reservoirs for which mercury TMDLs have been developed. Because the vast majority of mercury is known to be due to atmospheric sources, the TMDLs were developed using information from national surveys of mercury discharges from municipal point sources. This was justified because mercury concentrations are expected to be very low or zero in municipal point sources.

High values from the survey information were used to determine "future allocations," which may be assigned to point sources if the future characterization sampling detects mercury in any of the point source discharges. Measuring mercury at trace levels requires non-routine monitoring and lab analysis techniques. This effluent characterization monitoring will be conducted during the renewal of the permits within five years of the TMDL analyses.

The remainder of this section focuses on nutrients. The planning of future changes in major and minor point source discharges is tracked and assessed under Maryland's nutrient cap management strategy under the Chesapeake Bay Agreement 2000 (C2K). This tracking and assessment process is closely tied to enhancements being made to water and sewer planning procedures[13] and nutrient offset policies and procedures[14]. It is in the interest of local governments to understand these procedures as they relate to future sewer capacity planning and assuring consistency with TMDLs. (See Section 4.4 "A Framework for Offsetting Future Pollutants," and Section 5.3 "Land Use Planning").

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[13] See MDE, Draft Guidance "Water Capacity Management Plans", 2005 www.mde.state.md.us/assets/document/water/wastewaterCapacityMgmtGuidance.pdf See MDE, Draft Guidance "Water Supply Capacity Management Plans", 2005, www.mde.state.md.us/assets/document/water/WaterSupplyCapacityMgmtGuidance.pdf

[14] These are key operational issues that will be reflected in future refinements of this Guidance.

In some cases, it will make sense to use spray irrigation rather than direct surface water discharges. These spray irrigation operations have mature tracking, reporting and assessment procedures15. For a spray irrigation site next to an impaired stream, the groundwater discharge permit will impose a pretreatment limit for nitrogen (total N<8 mg/l for 2"/wk spray irrigation rate) so that after crop uptake, there is zero nitrogen in the percolate. This nitrogen pretreatment limit, land cost and storage pond installation should be considered when considering whether spray irrigation is a cost effective alternative.

In some cases, nutrient TMDL limits for point sources in localized waters are not as stringent as the point source cap maintenance strategy under C2K. In these cases, the TMDLs for localized waters provide information that could be useful in the future to determine if a point source may increase its load to accommodate growth without causing a localized impact. Of course, such an increase would necessitate a decrease elsewhere in the Bay watershed to maintain the Bay nutrient limit.

MDE is tracking the information needed to support assessments similar to the previous conceptual example. It is important for local governments to understand these concepts, to make use of them as elements of future planning.

In most cases, TMDLs identify a broad waste load allocation (WLA, the allocation for point sources). As an initial TMDL implementation planning step, a “Technical Memorandum” is developed, which supplements the TMDL document. The Technical Memorandum suggests a viable way to partition the total WLA among individual point sources; however, it does not represent a formal decision of the Department. That decision is made during the NPDES permitting process.

In some nutrient TMDLs for tidal waters, small point sources that are far upstream of the receiving waterbody are not included in the TMDL waste load allocation[16]. Instead, because they are so small relative to the upstream nonpoint source load, they are incorporated with the upstream load as part of the TMDL nonpoint source allocation. These point sources are tracked by MDE, and any future consideration of expansion is managed under the following broad set of operating rules. First, load increases must be consistent with the Chesapeake Bay nutrient cap maintenance strategy. Second, the increase may not cause a violation of water quality standards

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[15] In most cases, spray irrigation is performed on agricultural land. In these cases, the portion of the effluent that is subject to spray irrigation is tracked as part of the cropland load under a nutrient management plan. The same holds true for wastewater sludge application to cropland. Any effluent that is discharged to the surface water, for instance during winter months, is tracked in the normal manner as a point source load. (Please consult MDE regarding the tracking and accounting of other cases of spray irrigation, e.g., to golf courses or forested land.)

[16] TMDLs analyses require that a cause-and-effect relationship be established. Because changes in the small point sources have no effect in the water quality at the scale of the TMDL analysis, the TMDL analysis could not be used as a basis for setting a limit on the point sources. These plants are still given various permit limits that protect the water quality in the immediate vicinity of the plant.

in local tidal waters. Finally, the expansion must be consistent with non-tidal water quality standards in the immediate vicinity of the WWTP[17].

**In summary, the broad tracking and assessment of nutrients from traditional point sources is being done in accordance with Maryland's Chesapeake Bay nutrient cap maintenance strategy. Tracking the offsets for expansions will be managed in relation to the Bay limits, local tidal water quality constraints identified by TMDL analyses, and consideration of potential impacts in the immediate vicinity of the discharge.**

Stormwater: Because the EPA's interpretation of stormwater as a point source is new, most of Maryland's TMDLs do not include explicit waste load allocations for stormwater. However, those TMDLs account for regulated stormwater in the load allocation (NPS) component of the TMDL. In many cases, it is technically possible to disaggregate stormwater allocations from the NPS allocation; however, doing so will require a public process and amendment of the existing TMDLs. This will entail the future coordination of TMDL allocation revisions and MS4 permits.

**For the limited number of TMDLs in which stormwater waste load allocations (WLAs) are identified, separate allocations are identified for each political jurisdiction. Because of data limitations, these allocations are typically the aggregate of NPDES MS4 and industrial permits, including the transient loads from construction activities. The regulated stormwater WLAs are set at a value consistent with pollutant load reductions expected to be achieved under the existing permit. Thus, maintaining consistency with NPDES stormwater permits will ensure consistency with TMDL stormwater WLAs. Tracking, Assessment and reporting are addressed within current permit requirements.**

Because EPA's regulatory interpretation of stormwater as a point source is fairly new (2002), and information is limited, future refinements are anticipated for allocations to regulated stormwater. First, as more detailed information about individual stormwater sources is developed, allocations to industrial sources may be disaggregated from the stormwater WLAs allocations. This is not likely to be done for several years.

Second, stormwater allocations are not static, because land uses change. The stormwater WLAs must be revised periodically to reflect these changes, and this must be done via a public process. This will likely take place within the 5-year cycle of NPDES stormwater permit renewals. TMDLs that were previously developed without explicit WLAs for regulated stormwater will be refined in the same manner.

[17] The reader will note that three geographic scales enter the discussion; the Chesapeake Bay scale, the intermediate scale of protecting tidal tributaries to the Bay, and the scale of non-tidal streams that feed the tidal tributaries.

Nonregulated stormwater will be tracked and assessed in the same context as other nonpoint sources. The section below on "Land Cover as a Pollutant Source Category" addresses this matter. Also, see Section 4.4 "A Framework for Offsetting Future Loads" and Section 5.3 "Land Use Planning" for further insights.

#### 5.1.2.3 Atmospheric Sources

Some pollutants deposit from the atmosphere to the land surface and directly to the surface of waterbodies. It can be difficult to control atmospheric deposition, because some of the sources lie outside State or local jurisdictional boundaries. Most control efforts are regional, national or even international undertakings. Nevertheless, all sources, including atmospheric sources, must be accounted for in TMDL development and implementation. The following guidance addresses atmospheric sources of nutrients and mercury.

<u>Nutrients</u>: Atmospheric sources of nutrients deposit to the land surface and directly to surface waters. Those that deposit to the land are accounted for implicitly in estimates of nutrient loading rates from the various land use types. A significant component of nutrient loads from impervious surfaces, which readily wash off during storm events, originate from the atmosphere. This suggests that air pollution controls might eventually be a more cost-effective way of reducing urban nutrient loading; however, this subject is beyond the scope of this 2006 Guidance.

For TMDL analyses in which the surface area of the waterbody is fairly large relative to the watershed area, direct atmospheric deposition to the waterbody is accounted for explicitly. In these cases, the nonpoint source load allocation includes an atmospheric component that estimates the "current" average annual atmospheric load and the pollution reduction that is anticipated under existing federal law (e.g., the Clean Air Act).

> **For local planning purposes, it is sufficient to assume that where atmospheric deposition to water has been included explicitly in a TMDL, the anticipated load reductions will be achieved via compliance with the Clean Air Act.**

<u>Mercury</u>: Bioaccumulation of mercury in fish tissue has been documented in a significant number of reservoirs (impoundments) in Maryland. Atmospheric sources generally make up the vast majority of the load and, for broad planning purposes, can be viewed as the sole source unless there are other known sources. For this reason, local governments role in addressing mercury is limited.

#### 5.1.2.4 Land Cover as a Pollutant Source Category

For many TMDL analyses, the different types of land cover have been aggregated into four broad groups: urban; agriculture; forest and other herbaceous; and surface water. Surface water was addressed in the section above on atmospheric sources. The remaining categories are addressed below.

Nonpoint source (NPS) pollution is difficult to estimate for many reasons. It is subject to highly variable patterns of precipitation. It is typically generated in small amounts per unit area, but given the large surface area of land, large amounts of NPS pollutants are produced. This makes direct measurement of NPS pollution costly and extremely difficult, if not impossible. Thus, NPS pollution is generally assessed by indirect estimation procedures and long term averages[18]. One simple approach for estimating NPS pollution is to assign different average annual rates of pollutant loading to different types of land cover, expressed as a certain number of pounds per acre per year (average annual unit area loading rate).

For example, if one assumes that forest land generates 1.5 lbs/acre of nitrogen per year, then one can estimate that a 1,000 acre undisturbed forested part of a larger watershed will contribute about 1,500 pounds of nitrogen on average over the period of a year (some years more, some years less, depending primarily on the rainfall). Applying this logic to all different types of land cover can help establish a reasonable estimate of the total average annual nitrogen load from a watershed. Because this type of calculation is one common aspect of assessing consistency with a TMDL on a broad scale, land cover data is critical information to track.. (SEE Appendix E, "Nonpoint Source Nutrient Loading Assessments Using Chesapeake Bay Program Land Use Loading Coefficients" for further discussion).

<u>Forested Land and Wetlands</u>: It is generally understood that undisturbed forestland and wetlands contribute the least amount of nutrients in the form of nonpoint source runoff than any other type of land, and can act as a sink for pollutants. Given this insight, the conversion of these land covers to other types usually results in an increase in pollutant loads to some degree. For this reason, from the perspective of addressing water quality associated with pollutant loadings, tracking forestland and wetlands is critical.

In addition, forestland acts like a sponge in the way it absorbs rainwater. When the forest's absorptive capacity is lost, less rainwater soaks into the ground, and more of it runs off into streams. This additional surface runoff increases hydraulic energy, which increases erosive stress on the streams. Forestlands also serve as "reservoirs" that release water slowly thereby recharging streams with clean water during dry weather periods. When forestland is replaced with developed land, streams tend to have lower flows, or go dry, during dry weather periods. The increased erosive stress during wet weather periods, and decrease in stream flow during dry periods are reflected by low indices of biological integrity, which constitute a violation of water quality standards.

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[18] [redacted] it should be recognized that these loads are composed of contributions from storm events and base flow (groundwater recharge of streams). One substance that has been addressed in TMDLs in relation to individual storm events is biochemical oxygen demand (BOD – organic matter). The rapid decomposition of BOD by bacteria (hours to days) can cause oxygen deficits and lead to fish kill events. TMDLs for BOD in non-tidal streams, usually associated with point source discharges, include an assessment of the effect of storm events as a critical condition analysis. If the analysis suggests potential impairment, the point source discharge is generally regulated more strictly to account for this.

Tracking the amount and location of forested land and wetlands that are restored and conserved during the land development process is critical. This also implies that greater attention be devoted to considering policies and procedures designed to ensure the protection and restoration of forested land and wetlands. This subject is discussed further in Section 4.4 “A Framework for Offsetting Future Loads.”

Urban Land and Impervious Cover: Impervious land cover generally refers to surfaces on the land that prevent water from soaking into the ground. It is generally associated with land development (e.g., streets, buildings, sidewalks, parking lots), though natural rock surface and compacted soil also function as impervious cover. Impervious cover is the antithesis of forestland cover discussed above.

**In general, impervious land cover contributes to many of the water quality impacts that forest cover and wetlands prevent. The most prevalent impact is the physical degradation of non-tidal streams and resultant degradation of biological integrity.**

Since 1985, development activities, which create impervious cover, have been regulated by Maryland’s stormwater management law and regulations (COMAR 26.17.02). These regulations were enhanced in 2000 with the adoption of a new “Maryland Stormwater Design Manual.” The regulatory revisions focus on minimizing impervious cover through proper site design techniques and the use of nonstructural BMPs. The State stormwater law and regulation applies state-wide, including jurisdictions that are not subject to federal NPDES stormwater permits.

**The primary benefit of the State stormwater law, and implementing regulations, is to ensure that the physical integrity of non-tidal streams is protected during new land development. All jurisdictions routinely track and report their urban best management practices (BMPs).**

Development that occurred before Maryland’s stormwater law went into effect has made a substantial impact on the physical integrity of non-tidal streams. The effects of this legacy development are being addressed in two ways, which warrant local attention to tracking. First, The State stormwater law, regulations and local ordinances require the effective removal of a percentage of impervious cover during redevelopment of land that was originally developed before the stormwater law went into effect in 1985. “Effective” removal means various practices that modify runoff characteristics to mimic removal of impervious surfaces are credited as if the impervious surface was removed. For example, a green roof on a building, or an underground stormwater holding tank below a parking lot would be credited. Local governments under NPDES stormwater permits track these practices.

The second way that legacy impervious surface is being redressed is through requirements in NPDES stormwater permits. These permits, which cover all the significantly large urbanized jurisdictions, require the treatment of 10% of the impervious surface area during each five-year permit cycle. This "urban BMP retrofitting" is undertaken as part of a watershed management process, which includes routine tracking and reporting under the NPDES MS4 permits.

In principle, it is possible to map exactly what type of surface is covering each parcel of land. The practicality of this would be challenging, although some jurisdictions that have stormwater utility fee systems perform this type of tracking to a fairly extensive degree using geographic information systems (GIS). They require large commercial and institutional property owners to pay a fee based on the area of impervious cover. This necessitates a fairly precise accounting of land cover. As remote sensing and GIS technologies evolve, this degree of tracking could become viable some day. (See Section 5.7 "Long-Rang Capacity Building").

More commonly, the tracking of impervious cover is done in a less direct manner. This generally entails accounting for different kinds of land use and assigning accepted estimates of the percentage of imperviousness associated with that type of land. For instance, high-density residential development tends to have a greater percentage of imperviousness than low-density residential development. Table 5.1 provides typical percentages of impervious areas associated with different classifications of land cover.

**Table 5.1**
**Percentages of Average Impervious Area**

| Land Cover Type | Percentage of Impervious Area |
|---|---|
| Urban Districts | |
| Commercial | 85 |
| Industrial | 72 |
| Residential by Average Lot Size | |
| 1/8 acre or less (town houses) | 65 |
| 1/4 acre | 38 |
| 1/3 acre | 30 |
| 1/2 acre | 25 |
| 1 acre | 20 |
| 2 acres | 12 |

Source: TR20 Manual

Although current TMDLs do not make explicit use of impervious cover, it is an important feature to track for several reasons, aside from the practical reasons associated with stormwater management noted above. First, watershed modeling, such as that conducted by the Chesapeake Bay Program to estimate pollutant contributions from different land use types, often partitions developed land into proportions that are pervious and impervious. More accurate locally-derived information could be provided on a voluntary basis to the Chesapeake Bay Program to increase consistency between regional and local information.

Second, future TMDLs for biological impairments of non-tidal streams might consider effective imperviousness of watersheds in some regard. Having the capacity to track and assess the impacts of that important landscape feature would smooth the transition to addressing such TMDLs. (See Section 5.6.1 Case Study).

Finally, as indicated by the Maryland Stormwater Design Manual, attention to impervious cover is a fundamental variable in development site design. This same logic translates to planning at the subdivision and small basin scales, and plays a vital role in protecting healthy waters.

The majority of this section on urban land has focused on impervious cover. The remainder addresses urban non-impervious cover (pervious cover).

The management of pervious cover for water quality benefits is a subject that is not as mature as others, like agricultural land management. In principle, encouraging and tracking reductions in lawn fertilizing and the conversion of fertilized lawns to shrubs, trees and ground cover, could be done. However, given the large number of separate residential landowners, doing so presents practical challenges. As future development faces the limits of TMDLs, new incentives will emerge that might motivate innovative ways of overcoming these challenges.

For example, it is conceivable that a program of incentives for replacing high-maintenance lawns with low-maintenance ground cover could be established to reduce surface runoff and pollutant loads. The costs associated with such a program, including tracking the benefits, could be funded by a combination of local tax incentives and development impact fees motivated by future development's need to offset increases in pollutant loads. Such a program would have an apparent tracking need associated with it.

Similar innovative ideas, like urban reforestation programs, are also worth considering. Again, because the subject of managing pervious urban areas is evolving, it is one for which tracking and accounting procedures are not well established. It is, however, a subject ripe with potential.

<u>Agricultural Land</u>: For property tax purposes, a significant amount of "agricultural land" is actually forested. Thus, it is important to make a distinction with between "cropland" and "agricultural land".

The subject of tracking and assessing pollutant contributions from cropland is fairly mature. This is due to the large acreages of cropland and high contributions of nutrients from this land use category on a per-acre basis relative to other categories.

**Tracking and assessment of nutrients for agricultural cropland is performed by the Maryland Department of Agriculture. The information is reported to the Chesapeake Bay Program through a data consolidation process managed by the Maryland Department of Environment (until 2005, this process was managed by the Maryland Department of Natural Resources).**

Although local governments do not have the task of tracking information associated with pollutant contributions from cropland, some familiarity with simple methods of assessing those loads can be of value in the context of comprehensive planning and assessing offset potentials.

#### 5.1.2.5 Septic Systems

Septic systems are typically associated with nutrients and bacteria pollutants; however, anything that can go down a drain is a potential pollutant issue relative to septic systems. Local health departments are delegated authority through subdivision regulations to ensure the proper citing of septic systems relative to drinking water wells. In the case of failing septic systems that pose a bacteria contamination health risk, owners are compelled to repair their systems to be in compliance with local health regulations regardless of federal water quality standards and TMDLs. Maryland regulates septic systems for potential bacteria contamination of swimming beaches and shellfish harvesting areas. Given that these health-related programs guide local government policy and procedures for addressing bacteria from septic systems, the remainder of this subsection will focus on nutrients.

Identifying and tracking locations of all septic systems is no small matter. One way of estimating this is to assume that homes not on public sewer systems are on septic systems; however, some of these might use holding tanks and others might use small "package" treatment plants. Discussions in relation to the 2004 Bay Restoration Fund law have considered this subject; however, no decision has been made to create a GIS database of septic systems.

Assessing the nutrient contribution to waterbodies from septic systems is also not an easy task. Estimating nutrients going into the drain field is fairly well understood; however, estimating how much of that nutrient eventually reaches a waterbody is a challenge. Studies using monitoring wells have been conducted, but even these do not guarantee accurate estimates.

Given the many variables, complexities of different soils, distances of systems to the nearest waterbody, depth to the saturation zone and so forth, averaging techniques are used to estimate the nitrogen loads of large numbers of systems[19].

The following estimate, average household size in Maryland, follow assumptions used by the Chesapeake Bay Program to estimate the load from a residential septic system:

9.5 lbs/yr/person/household to the septic drain field
2.6 people/household (See: household size estimates by County www.mdp.state.md.us/msdc/dw_popproj.htm )
40% loss of nitrogen during transport from the septic field to the surface water.

These assumptions produce the following average annual septic system loading rate:

2.6 x 9.5 x 0.6 =14.8 lbs of Nitrogen per year per septic system delivered to surface water

[19] Phosphorus loads are generally assumed to be zero from septic systems, because it tends to bind to soils; however, some studies of lakes have indicated contributions of phosphorus from nearby septic systems.

Note this is an average, implying that some septic systems generate greater loads, and others generate lesser loads.

Another means of estimating the septic contribution on a broad geographic area is provided in Appendix E "Nonpoint Source Nutrient Loading Assessments Using Chesapeake Bay Program Land Use Loading Coefficients."

Additional guidance on assessing septic system loads is provided in Section 4.4 "A Framework for Offsetting Pollutant Loads," in which a credit accounting policy is described for connecting septic systems to a sanitary sewer system.

#### 5.1.2.6 Stream Corridors

Many miles of non-tidal streams in Maryland are physically degraded, which is evidenced by signs of erosion and biological impairments identified on the 303(d) List. This erosion of the stream channels releases pollutants, which are transported to downstream waters (reservoirs and tidal tributaries of the Chesapeake Bay). Other streams, embedded with eroded sediments from the surrounding watershed, are also impaired and contribute pollutants to downstream waters.

Motivated by both of these upstream and downstream impairments, investments are being made to restore the streams. This includes physical stream channel restoration, restoration of riparian buffers, restoration of wetlands, stream protection with and without fencing, and recovery of flood plains. Upland stormwater management, to reduce stormwater runoff energy and control upland erosion, is often a necessary element of stream restoration that must be assessed. The tracking and reporting of the upland control practices is done through stormwater regulation.

The tracking of stream restoration activities is not as evolved as it is for some other activities. This is because much of the consolidated tracking in Maryland has been motivated by the Chesapeake Bay Program's nutrient reduction efforts over the past decades. The nutrient benefits of stream restoration have not been well quantified. Consequently, there was a lack of motivation for tracking stream corridor activities (the same can be said today for tidal shoreline erosion management practices). Now, owever, based on data collected in part from a local government in Maryland, a quantified estimate of nutrient reductions associated with stream restoration has been developed (See: BMP reduction efficiency information referenced in Section 5.2 "Tools and Resources").

Like other pollution reduction activities, stream restoration projects are usually tracked by the funding source; however, this information is not typically consolidated for functional use in planning and environmental management decision-making.

As noted in Section 5.1.1, DNR performs the consolidated tracking function for "natural resources" restoration activities, which ideally would include stream corridor activities. The present tracking includes riparian buffers and certain wetland restoration projects. The US Department of Agriculture's Conservation Reserve Enhancement Program (CREP) funding covers about 95% of these projects, and the data is reported to DNR by field foresters and MDA. MDE reports wetland restoration projects to DNR.

A method for the consolidated tracking of stream restoration projects has not been established. Supported by federal grant funds, DNR extracted stream restoration project information from MDE's archived records.

> **Local governments covered by NPDES stormwater permits are encouraged to track stream restoration projects, and the funding sources, for inclusion as part of their routine NPDES reporting process. They are also encouraged to use common sense and share experiences with other jurisdictions, given the acknowledged lack of standardized tracking methods at this point in time.**

It is possible that beneficial stream corridor activities are being documented locally as a routine matter in relation to other programs like implementation of the Forest Conservation Act and local flood plain management ordinances. In time, working jointly with the State, local governments might find it worthwhile to consider the consolidation of this information in order to document credit associated with TMDL implementation.

### 5.1.3 Water Quality Monitoring

The "tracking" of various activities provides information to be "assessed" as a means of judging progress on TMDL implementation. Although TMDL analyses explicitly link pollutant loads to water quality, tracking and assessing progress of TMDL implementation focuses on pollutant loads. Ultimately, however, water quality information must be assessed directly to evaluate progress. In addition to its evaluation function, monitoring information can also be used to target the location of implementation activities.

The State is responsible for water quality monitoring to identify impaired waters and evaluating water quality to determine if TMDLs are being achieved. Local governments or other groups may conduct additional monitoring to supplement the State monitoring. This may be done to document the effectiveness of innovative projects and programs, or to provide additional information about impaired waterbodies and pollutant sources.

From the perspective of TMDL implementation the purposes of monitoring can be categorized into two basic functions: 1) assessing pollutant or stressor sources, whether managed by BMPs or unmanaged, and 2) assessing the attainment of water quality standards. These are elaborated below.

1. Assessing pollutant or stressor sources is useful in planning (e.g., targeting) and evaluating implementation. Some examples follow:

- Monitoring pollutant loads delivered to reservoirs and tidal waterbodies by non-tidal streams:
  - Can serve as a diagnostic tool to target upstream sources for remediation.

  - Can be used to demonstrate a trend in loads relative to implementation, e.g., point source controls, upland NPS BMPs or stream corridor restoration.
  - Can serve the second basic function of assessing the attainment of standards in the non-tidal stream itself (this is an overlap with the second basic monitoring function outlined below).
- Monitoring baseflow concentrations in nontidal streams:
  - In the case of nutrients, this can help to target implementation to areas of high concentrations.
  - Can provide information for point source permitting decisions.
  - Can provide information to the biological stressor identification process and other diagnostic needs.
- Monitoring the function of a best management practice (BMP):
  - Can serve as research to improve knowledge about the pollutant removal efficiency of a BMP for extrapolation in estimating the reductions from similar BMPs.
  - Monitoring 2006 progress of implementation in the immediate vicinity of a set of BMPs:
  - Measuring the pollutant concentration in the base flow of small streams or in shallow monitoring wells to evaluate agricultural BMPs, spray irrigation practices, and septic systems.
- Monitoring discharges to waterbodies:
  - Treatment plant discharges.
  - Stormwater outfalls and other concentrated sources of stormwater runoff.
- Monitoring bottom sediments as a potential source of pollutants or stress:
  - Nutrient fluxes.
  - Oxygen demand.
  - Toxic contaminants.
- Monitoring atmospheric sources (at the source, as deposition at the receptor).
- A wide variety of monitoring is also required under various permits.

2. Assessing the attainment of water quality standards. This is generally the responsibility of the State; however, the State is required to consider all readily available data of sufficient quality when conducting mandatory water quality assessments under the Clean Water Act.

- Tidal and non-tidal long-term monitoring at fixed stations that can characterize time trends in water quality. Limited in geographic coverage. Generally a function of DNR.
- Intensive sampling studies of major waterbodies to characterize more detailed geographic aspects of water quality. Limited in temporal coverage. Generally a function of MDE.
- Random non-tidal biological monitoring that can measure statistical trends in the health of Maryland streams in general (Maryland Biological Stream Survey). This monitoring also has the explicit purpose of assessing the impacts of atmospheric acid deposition (e.g., acid rain). Generally a function of DNR.
- Continuous monitoring of shallow tidal waters to evaluate the shallow water criteria of the Chesapeake Bay. Generally a function of DNR.
- Assessment of fish tissue for toxic substances. Fish function as sentinels; fish tissue violations prompt the State to consider further source assessments, which may be performed

within the context of TMDL development and implementation. Generally a function of MDE.

- Shellfish monitoring for bacteria. A function of MDE.
- Beach monitoring for bacteria. A function delegated by MDE to local government health departments.
- A wide variety of in-stream monitoring is also required under various permits.

In summary, the State is responsible for assessing the waters of the State, both to identify impairments and to evaluate the progress of TMDL implementation.

The State must consider other sources of data when assessing the waters of the State. This includes data from local governments, private parties, academic institutions, and the general public. The consideration of data does not imply that the data must be used if not of sufficient quality. That said, data that do not meet certain quality criteria can still be of value in providing insights and clues to guide further investigation.

Finally, although the State is responsible for water quality monitoring, as described above, local governments and others are welcome to conduct monitoring. It is strongly recommended, however, that prior to investing in such monitoring, effort be made to coordinate with the MDE to ensure that proper methods are used.

## 5.2 Tools and Resources

This section provides a consolidated collection of tools and references to helpful resources. This information will be supplemented in the future as new information becomes available.

### 5.2.1 Tools

TMDL implementation tools should be viewed as spanning the same range as land use planning, from comprehensive plans to site plans (See Section 5.3.4). Many of the existing tools used to support decision-making across the full range of geographic scales can be adapted to serve as tools for TMDL implementation planning.

Load Estimations: Standardized procedures and tools for estimating NPS loads are being developed for use in local decision-making. In the 2006, Section 4.3.1.5 recommends the use of information and analytical tools that are consistent with the regional Chesapeake Bay Agreement Tributary Strategies (See Appendix E). Despite limitations, computations using the Bay program loading rates provide an internally consistent framework for decision-making, which is peer-reviewed, and accepted by the US EPA. Decisions based on analyses using this framework should be tested by common sense and professional judgment.

Until the State adopts standardized procedures, any technically justifiable load estimation tool may be used. For example, The Center for Watershed Protection (CWP) maintains spreadsheet-based tool called the Watershed Treatment Model (WTM) that can be used to evaluate nutrients, sediments, metals and bacteria. It addresses a wide range of pollutant sources and control options. It allows the user to adjust these loads to evaluate multiple alternatives for watershed treatment. See the appendix to "A User's Guide to Watershed Planning in Maryland:" http://dnr.maryland.gov/watersheds/pubs/userguide.html

Although Maryland's "Scenario Builder" is designed for the ten large Tributary Strategy basins, its results could be interpreted for nutrient reduction planning in smaller watersheds. This tool accounts for the non-additive effects of multiple BMPs on the same land parcel and provides cost estimates. www.dnr.state.md.us/bay/tribstrat/tsdw/scenario_builder.html

BMP Information: The EPA Chesapeake Bay Program maintains the latest information on best management practices (BMPs) for nutrients and sediments. Because sediment controls also control the pollutants that attach to sediment particles, it can be a reasonable surrogate for other pollutants, e.g., bacteria. This BMP information can be accessed via the web link: www.chesapeakebay.net/tribtools.htm

- Reduction Efficiencies: The "trib tools" web page cited above includes a section on "Best Management Practices" toward the bottom of the page. See "Nonpoint Source Best Management Practices" for information on BMP reduction efficiencies.

- BMP Unit Costs: A table of unit costs for BMPs is included in Appendix I.

### 5.2.2 Resources

The following resource references are not comprehensive, but provide a good starting point on many topics relevant to TMDL implementation. They are presented in alphabetical order.

**303(d) List:** See "Impaired Waters" under "Water Quality Standards."

**Antidegradation Waters:** See Tier II waters under "Water Quality Standards."

**Bacteria TMDL Implementation:**

Bacteria TMDL Implementation Plans: Virginia has fairly extensive experience with TMDLs for bacteria. Although their TMDL development methodologies are different from those used in Maryland, the implementation actions identified in Section 6.0 of their bacteria implementation plans (IPs) have wider applicability. Their IPs also provide cost effectiveness information, which might prove useful. http://www.deq.virginia.gov/tmdl/iprpts.html

**Contacts:**

Stakeholder Involvement: See Section 3.5 "Stakeholder Involvement" of this Guidance document.

Multi-jurisdictional Coordination: See Section 5.8.3 "Contacts" of this Guidance document.

**Drinking Water Supply Management**

Draft MDE Guidance "Water Supply Capacity Management Plans", 2005,
www.mde.state.md.us/assets/document/water/WaterSupplyCapacityMgmtGuidance.pdf

See "Source Water Assessment" below.

**Financial Assistance:**

The following resources are in alphabetical order. The brochure, "Grants and other Financial Assistance…" provides fairly comprehensive information. Additional references are included to supplement that brochure.

Environmental Finance Center
4511 Knox Road, Suite 205, College Park, MD 20740
phone: (301) 403-4610, ext 24, fax: (301) 403-4222, email: efc@umd.edu
http://www.efc.umd.edu/

Financing Alternatives for Water Quality: The EFC has developed matrices of financing alternatives for wastewater, the agricultural sector, developed lands, and forests. http://www.efc.umd.edu/our_work/matrices.cfm

Grants and other Financial Assistance Opportunities at MDE (Includes links to federal grants) http://www.mde.state.md.us/aboutmde/grants/index.asp

Water Quality Improvement Assistance (brochure developed by MDE) http://www.mde.state.md.us/assets/document/Water%20Quality%20Assistance_090804.pdf

MDE Barrowers Manual, Appendix L describes the system used to rank projects for a wide variety of capital funding sources, including grants and loans: http://www.mde.state.md.us/assets/document/Water/app_100.pdf

Coastal Communities Initiative Grant (MD DNR): http://www.dnr.state.md.us/bay/czm/index.html

Landowner Incentive Program (MD DNR): http://www.dnr.state.md.us/wildlife/lip.asp

**Forestry Management:**

EPA recently published new National Management Measures to Control Nonpoint Source Pollution from Forestry, a technical guidance and reference document for use by State, Territory, and authorized Tribal managers as well as the public in the implementation of nonpoint source (NPS) pollution management programs in forest settings. The new guidance contains information on the best available, economically achievable means of reducing nonpoint source pollution that can result from forestry activities. http://www.epa.gov/owow/nps/forestrymgmt/.

Maryland Forest Service: www.dnr.state.md.us/forests/

**Geese: Managing Resident Geese:** http://lakeaccess.org/urbangeese.html

**Green Building:**

Maryland Green Building Network (GBN) is an ad-hoc, informal group of architects, builders, contractors, developers, planners, landscape architects, related professionals, and citizens. Numbering over 1,000 individuals and affiliations, the Network focuses on promoting and encouraging the design and construction of buildings, and the development of sites, in a manner that encourages efficient use of natural resources and raw materials, protects the environment, and promotes sustainable communities.
http://www.dnr.state.md.us/ed/mdgbn/

US Green Building Council
The U.S. Green Building Council (USGBC) members work together to develop LEED products and resources that support the adoption of sustainable building. LEED, Leadership in Energy and Environmental Design, is a green building rating system designed to accelerate the development and implementation of green building practices. http://www.usgbc.org/

**Impaired Waters List:** See "Impaired Waters" under "Water Quality Standards."

**Land Conservation:**

Maryland Environmental Trust Land Trust Assistance Program:
A land trust is a non-profit organization devoted to land preservation. It can be a private non-profit or public, like the Maryland Environmental Trust. This website has contact information for many local land trust organizations.
http://www.dnr.state.md.us/met/landtrusts.html

**Land Use Planning and Water Quality:**

"Protecting Water Resources with Smart Growth"
http://www.epa.gov/smartgrowth/water_resource.htm

EPA Brochure: "Growth & Water Resources: The link between land use and water resources" Includes links to other documents and resource links.
http://www.epa.gov/water/yearofcleanwater/docs/growthwater.pdf

Land Use Planning Models and Guidelines. Maryland Department of Planning publications. Order forms may need to be FAXed to purchase some of the documents.
http://www.mdp.state.md.us/order_publications.htm

"Eight Tools of Watershed Protection in Developing Areas" EPA training module.
http://www.epa.gov/watertrain/protection

**Maryland Department of Environment Water Publications:**
http://www.mde.state.md.us/researchcenter/publications/water/index.asp

**Maryland Department of Environment Permit Guide:**
http://www.mde.state.md.us/Permits/busGuide.asp

**Maryland Stormwater Design Manual:**
http://www.mde.state.md.us/programs/waterprograms/sedimentandstormwater/stormwater_design/index.asp

**Pesticides and TMDL Implementation:**

California: TMDL implementation plans are required as part of the TMDL development process. This link is to a specific case for pesticides in the San Joaquin River (California's Highly Agricultural Central Valley).
http://www.swrcb.ca.gov/rwqcb5/programs/tmdl/sjrop/OPImpWrkShp_091002.pdf

**Sediment TMDL Implementation:**

Sediment TMDL Implementation Plans: Virginia has some experience with TMDLs for sediment.
http://www.deq.virginia.gov/tmdl/iprpts.html

Soil Conservation District, Maryland Association of web site:
http://www.mascd.net/scds/MDSCD05.htm

**Source Water Assessment:**

EPA Web Page: http://www.epa.gov/ost/biocriteria/stressors/stressorid.pdf

MDE Source Water Assessment Fact Sheet and Guidance:
www.mde.state.md.us/programs/waterprograms/water_supply/sourcewaterassessment/index.asp

**Stormwater:** See Maryland Stormwater Design Manual

**TMDL Implementation**

Maryland TMDL Implementation Web Page:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/implementation.asp

National Examples: *The inclusion of these examples is not intended to constitute an endorsement.*

- California: TMDL implementation plans are required as part of the TMDL development process. Specific Case of Pesticides in the San Joaquin River (California's Highly Agricultural Central Valley).
  http://www.swrcb.ca.gov/rwqcb5/programs/tmdl/sjrop/OPImpWrkShp_091002.pdf
- Georgia:
  http://www.northgeorgiawater.com/pdfs/CH2M-SW/TM8(11-22-02).pdf
- Minnesota: Implementation Cost Estimate Method for Stormwater, PowerPoint
  http://www.stormwater-resources.com/Library/154TTMDLImplementation.pdf
- South Carolina: Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources. Submitted to EPA September 1998
  http://www.scdhec.net/eqc/water/html/npsplan.html
- Implementing TMDLs in Texas: A Status Report, July 2004
  http://www.tnrcc.state.tx.us/water/quality/tmdl/TMDLStatus03.pdf

- Texas TMDLs and Associated Implementation Plans
  http://www.tnrcc.state.tx.us/water/quality/tmdl/tmdl_projects.html
- Virginia: Guidance Document, Draft and Final Implementation Plans for Bacteria TMDLs, and Implementation plan development schedule.
  http://www.deq.virginia.gov/tmdl/implement.html

See Section 3.2 "Legal Landscape" for additional references to guidance on TMDL development and implementation.

**Wastewater Planning:**

Draft MDE Guidance "Wastewater Capacity Management Plans", 2005
www.mde.state.md.us/assets/document/water/wastewaterCapacityMgmtGuidance.pdf

**Water Quality Standards:**

Designated Uses COMAR 26.08.02.02
www.dsd.state.md.us/comar/26/26.08.02.02.htm
www.dsd.state.md.us/comar/26/26.08.02.02%2D1.htm

Water Quality Criteria COMAR 26.08.02.03, .03-1, .03-2, .03-3, and .03-4
General: www.dsd.state.md.us/comar/26/26.08.02.03.htm
Toxic Substances: www.dsd.state.md.us/comar/26/26.08.02.03%2D1.htm
and www.dsd.state.md.us/comar/26/26.08.02.03%2D2.htm
Criteria Specific to Designated Uses: www.dsd.state.md.us/comar/26/26.08.02.03%2D3.htm
Biological Criteria: www.dsd.state.md.us/comar/26/26.08.02.03%2D4.htm

Tier II waters for which the antidegradation policy applies:

- Maps, organized by county, are available from MDE that identify the locations of the Tier II streams. Contact Jim George jgeorge@mde.state.md.us
- Antidegradation Policy www.dsd.state.md.us/comar/26/26.08.02.04.htm
- Anitdegradation Implementation Procedures and coordinates of Tier II Streams: www.dsd.state.md.us/comar/26/26.08.02.04%2D1.htm

Impaired Waters: Maryland's 303(d) List identifies impaired waterbodies. Below is a link to a searchable database of the 303(d) list:
www.mde.state.md.us/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/303d_search/index.asp

**Watershed Planning:**

EPA watershed planning handbook:
http://www.epa.gov/owow/nps/watershed_handbook

A User's Guide to Watershed Planning in Maryland:
http://dnr.maryland.gov/watersheds/pubs/userguide.html

**Wetlands:**

Maryland's Wetlands and Waterways webpage:
http://www.mde.state.md.us/Programs/WaterPrograms/Wetlands_Waterways/index.asp

## 5.3 Land Use Planning

*"The health of our waters is the principal measure of how we live on the land"*
*Luna B. Leopold*

The statement above by the renowned conservationist Luna Leopold provides a context for understanding the relationship of Total Maximum Daily Load (TMDL) implementation to land use. Poor water quality ("impaired waters") exists primarily because land use activities have resulted in the excessive discharge of pollutants into waterways. Although pollutants such as nutrients and sediment are rather ubiquitous, water quality and biological monitoring programs suggest that the number of impairments (and therefore TMDLs) for other pollutants, as well as the physical degradation of streams, is generally greater for urbanized watersheds.

Land use planning, particularly as influenced by the local comprehensive plan, is an essential tool for addressing existing TMDLs and the prevention of future water quality impairments. The purpose of this section of the Guidance is to provide some first thoughts about the evolution in local comprehensive land use planning and implementation needed to better address TMDLs (and potentially other environmental management challenges).

This section does not presently describe how to conduct analyses toward this end. Rather, it serves as a road map that begins to layout key concepts and to identify complicating factors such as potential unintended consequences of TMDLs in relation to principles of Smart Growth.

### 5.3 1 Traditional Comprehensive Planning and the Environment

It is useful to first define planning and the purpose of the comprehensive plan. As a process, the objective of planning is the effective management of changes to the use of land. The comprehensive plan provides the vision and goals for how the public wants their communities to appear and function. The comprehensive or "master" plan also provides recommended policies and actions to achieve these desired outcomes. Comprehensive planning is an appropriate tool for addressing TMDL implementation; however, to accomplish this, the range of issues considered and analyses conducted during the comprehensive planning process needs to be expanded beyond the traditional focus.

The traditional treatment, if any, of environmental protection in comprehensive planning often consists of developing an inventory of "sensitive" resource areas with policies to protect them from loss due to development. Maryland's Economic Growth, Resource Protection and Planning Act of 1992 (Planning Act of 1992) requires local jurisdictions to adopt a sensitive areas element that protects streams and their buffers, 100-year floodplains, habitats and endangered species and steep slopes from adverse effects of development (Codified at § 3.05(a)(1)(viii), Article 66B, Annotated Code of Maryland). Generally, this has resulted in the treatment of sensitive areas as a constraint to development.

Furthermore, environmental considerations are typically relegated to the role of site design, a stage in the overall land use planning process that is often arguably too late. Without effective land use planning, site design planning typically cannot provide effective tools for resolving the inevitable conflicts between providing for livable communities and a sustainable environment. In many of Maryland's jurisdictions, environmental standards have not been sufficiently incorporated into early stages of land use planning and into implementation processes.

Maryland's Planning Act of 1992 provides guiding principles to address development's impact on natural resources early in the planning process through the Act's eight visions. See the section "Full Range of Land Use Planning" below. Subsequent to the Planning Act of 1992, Maryland passed its Smart Growth Initiatives intended to implement the visions of the 1992 Planning Act. These initiatives, particularly relevant to environmental concerns, include Priority Funding Areas (PFAs) and the Rural Legacy Areas (RLA). For more information on PFAs and RLAs, go to www.mdp.state.md.us.

Significant to note are efforts of some of Maryland's more urbanized local jurisdictions to address development's impacts on natural resources in comprehensive planning efforts prior to Maryland's passing of the 1992 Planning Act. Notable experiences can be found in Baltimore County's establishment of an urban growth boundary and its resource conservation zoning and Montgomery County's Transfer of Development Rights Program and development of Special Protection Areas. These measures attempt to address water pollution from septic systems, development threats to drinking water reservoirs, and encroachment of development into productive agricultural areas.

To address environmental considerations earlier in the planning process, the question that must now be asked is what are appropriate land use planning standards for achieving environmental quality goals? What should community standards be for the control of pollutant load generation? Water quality standards and TMDL analyses provide targets for answering these questions. The challenge is to integrate the disciplines of land use planning and watershed planning in a balanced manner to achieve the desired environmental goals while also meeting other necessary social goals, such as affordable housing, appropriate location of development, and sustainable businesses including agriculture.

### 5.3.2 New Challenges

The need today to assure environmental protection through land use planning presents significant practical challenges for planning at both the comprehensive and community levels. Expanding the objectives and process of comprehensive planning is critical to success. However, investing in the capacity to conduct this kind of proactive planning has practical administrative benefits.

Addressing water quality in a quantitative manner at the early stage of comprehensive land use planning and implementing the appropriate land use and growth management tools will help to ensure greater certainty and efficiency for future development, a benefit to developers for whom time is money. It will also reduce local government costs in two ways. First, the greater certainty and efficiency during the development process, afforded by advanced planning, will reduce delays associated with uncertain legal liabilities as well as the time invested by local staff and officials to review plans and make decisions. Second, conducting advanced planning to ensure that water quality is improved or maintained will reduce the costs of fixing problems created by development after they occur.

In terms of land cover, the main cause of impairments is the altering of the landscape's natural hydrology, loss of natural resource lands most effective in filtering pollutants (e.g., wetlands and forest cover), and increased impervious surfaces, particularly in relation to dispersed development patterns and the increased need for stormwater management and transportation infrastructure. Roads and parking lots generate high pollutant loads particularly when connected directly to storm drain systems. Runoff constituents from these surfaces such as metals and petroleum by-products, typically poorly controlled by stormwater management systems, a condition that is often not well understood by the public and many planners. Despite toxicological research, the effects of these substances in the natural environment, particularly in combination, are also not fully understood. Thus, the temptation to focus attention narrowly on better understood substances, like nutrients, runs the risk of failing to address these pollutants until it is too late. The issue of impervious cover is one where both advanced land use planning, and implementation standards and guidelines need to be enhanced to meet the goals of restoring and protecting water quality.

With regard to land use planning, some local governments are beginning to incorporate limits on impervious cover as part of their sector planning process. Although caution is advised on simply placing a fixed limit on the percentage of impervious cover, practical experience is being acquired with area planning methods that explicitly address impervious cover. The information technology and computing tools are close at hand to conduct these analyses. (See Section 5.6 for a case study).

While some have advocated approaches involving "low impact development" and "environmentally-sensitive site design," many planning codes are outmoded, resulting in regulatory, bureaucratic and financial barriers to innovative development techniques. That is, current codes are often an impediment to meeting water quality standards. For example, local codes generally have minimum requirements regarding the provision of parking, but few codes place a maximum limit on the creation of parking. This promotes over-design of parking lots and thus excessive impervious cover. As planners and policy leaders begin to understand that stormwater management and other site design regulations for new development are not fully adequate to control these water quality impacts, comprehensive planning and its implementation will become more effective.

### 5.3.3 TMDL Guidance as a Road Map to Enhanced Land Use Planning

The list of measures below is intended to stimulate dialogue about the role of comprehensive planning and implementation to address TMDLs. This list presents general concepts with the understanding that there needs to be consistency and follow-through between the comprehensive plan and its implementation tools; as such, it does not repeat the same ideas for the comprehensive plan, zoning, subdivision regulations, and site design requirements. Consistent with the overall intent of the MDE Guidance, this list suggests steps that the State and local governments should consider jointly to improve the financial, technical and administrative capacity to manage land use in a quantitative manner to protect and restore water quality. (See Appendix B for a list of other issues to be considered when refining this Guidance).

1. **Basic Context of Land Use and Environment** - Local comprehensive plans need to include a vision and a consistent set of goals, policies, and action recommendations to address the impact of land use on protecting and restoring water quality standards. Plans should note that the protection and provision of clean air, water, and land resources is not only a matter of legal consistency, but a necessary part of the local quality of life. Addressing pollution closest to the source is preferable to management of pollutants "downstream". In instances where addressing pollutants closest to the source prohibits development and/or redevelopment in growth areas, a watershed approach should be used to address far field impairments and provide a means for adequate offsets.

2. **Areal Relationships** - Local comprehensive plans and their implementation should relate areal land use planning units (community or sector boundaries, management areas, etc.) to functional environmental units (watersheds in the context of TMDLs). Because local jurisdictional boundaries often split watersheds, municipalities, counties and state agencies also need to work together to address inter-jurisdictional issues. For some jurisdictions, this is also an inter-state issue. (See Section 5.8 Multi-jurisdictional Coordination).

3. **Local Governments** – Comprehensive plans should acknowledge the special issues of land use and water quality in relation to municipalities. Issues that should be addressed include land use authority, annexation, and coordination of infrastructure planning. Municipalities, counties, and state and federal agencies need to work together regarding which units of local government will be responsible for TMDL implementation and how conflicting roles of counties and municipalities can be addressed. The recommendation to identify local government coordinating committees, advanced in Section 3.4.1 "Intra-governmental Coordination," is intended to address this and similar issues. The identification of a local group with multi-disciplinary knowledge will provide a key point of contact for the State to communicate with municipal and county governments on these kinds of topics.

4. **Performance Standards -** Planning needs to develop performance standards and guidelines for the environment. For older development without stormwater management, planning should strive to restore natural resource lands and habitat, and improve water quality. Care should be taken to avoid the unintended consequence of driving development outside of growth areas. In growing rural and suburban designated growth areas, advance planning can be used to minimize the cost and administrative burden of maintaining consistency with TMDLs and the antidegradation policy (See Section 4.2.3 on implementing the antidegradation policy). The State is committed to working with county and municipal governments toward the adoption of indicators that reflect these goals. Section 4.1 of the Guidance describes how TMDLs and water quality standards are intended to serve as these indicators. The next section discusses the need for analytical methods that link land use planning elements to environmental outcomes.

5. **Environmental Analyses -** For growing suburban and rural watersheds, local comprehensive plans should include analyses relevant to the relationship of land use and

functional environmental outcomes, such as: analyses of pollutant loads associated with existing and projected land use and of impacts due to impervious surfaces, considering percentage and per capita imperviousness for planning areas, in relation to sub-watersheds. Where possible, analyses should include traditional chemical water quality, biological impairment, and stream channel stability. Evaluation of the distribution of protective forest cover, including total watershed forest coverage and forest coverage within stream buffers and on steep and erodible slopes, should also be considered.

Appendix E "Nonpoint Source Nutrient Loading Assessments Using Chesapeake Bay Program Land Use Loading Coefficients" provides 2006 guidance on addressing nutrients. Section 4.4 "Maintaining Water Quality: A Framework for Offsetting Future Loads," discusses a means of evaluating forest cover from the perspective of managing nutrient loading. The Maryland Stormwater Design Manual provides a wide array of detailed technical analysis methods that can be adaptated to larger area planning for impacts of impervious land cover.

As this Guidance is refined, the previous list of issues can be expanded. The analyses that address these issues can be refined and tailored for differing land cover, various waterbodies and associated water quality standards, different types of TMDL analyses, and specific cases like options for very challenging circumstances.

6. **TMDLs, Tradeoffs, and Smart Growth -** Comprehensive plans should consider the jurisdiction-wide tradeoff of development patterns regarding water quality impairments and sound land use concepts, e.g., targeting growth to Priority Funding Areas (PFAs). A special issue is that older urban development predating water quality standards probably fails to meet today's water quality standards. Although improvements in water quality are possible in such areas, it will be infeasible to raise physical, chemical and biological water quality to levels achievable in a rural setting. This is an active area of public policy discussion and another key subject for dialogue during refinement of this Guidance.

   Land use planning should continue to promote principles of targeted growth, but strive to improve water quality in the process. Preserving the rural character of a local jurisdiction, and open space in general, is an environmental goal that could necessitate the balancing of water quality goals. When considering the following itemized guidance points, planning should strive to avoid the potential unintended consequence of driving development from concentrated areas of development into the countryside.

   First, it is desirable to create incentives that promote the redevelopment of older urban areas that predate State stormwater regulations. This requires flexibility when addressing stormwater from redevelopment projects. Flexibility is afforded by allowing offsets elsewhere in a watershed when site constraints prohibit stormwater management on site. State law requires the reduction of impervious surfaces during redevelopment projects, which provides an incremental improvement in water quality in areas that would otherwise go unimproved due to lack of resources. (Editorial NOTE: the first and second sentences refer to incentives and the third sentence refers to requirements. It is acknowledged that the requirement can act as a disincentive for redevelopment.)

Second, new development that will displace agricultural land should be leveraged to include stream restoration to help restore biologically impaired streams. This is consistent with the standards expressed in State guidance entitled, "Preparing a Sensitive Areas Element for the Comprehensive Plan" (Maryland Department of Planning, May 1993, p.10), and with the federal Clean Water Act.

Third, new development should be targeted to avoid deforestation. This is motivated both as a means of protecting healthy stream channel integrity and as a means of avoiding the need to offset increases in pollutant loads that accompany deforestation (See the hypothetical watershed example in Section 4.4.2 "Technical and Administrative Procedures to Support Pollutant Offsets ").

Fourth, it is desirable to identify potential areas for reforestation in an amount of acreage estimated to reduce any excess pollutants and offset pollutant loads from proposed development areas. Section 4.4 provides guidance on how to perform planning level calculations to do this. It should be recognized that the general subject of pollutant offsets is evolving both as a technical and public policy issue.

Fifth, plans should demonstrate that dense development within designated growth areas is offset by the protection of natural resources and rural areas. This can be demonstrated by development area capacity analyses and evaluation of rural-to-urban area ratios. As in the case of Baltimore County, where the rural to urban land area ratio is 2:1, such ratios should be significant.

In summary, healthy water quality must be protected and impairments must be addressed and improved even where it is infeasible to achieve water quality standards at present. TMDL implementation in the context of land use planning should be balanced with the broader set of environmental issues (e.g., targeted growth and other TMDLs[20]) and social mandates (e.g., public safety and affordable housing). It is important that comprehensive plans recognize that TMDL implementation should not result in the abandonment of growth management commitments or targeted development at reasonable densities.

7. **Strategies for Existing Development** – When conducting planning for sub-watershed areas with existing and older development without stormwater management, comprehensive plans should commit to reducing future cumulative pollutant and hydrologic loads. Strategies for this include: improving water quality through reduction of impervious surfaces during re-development; including green roofs; removing "unused" impervious surfaces (on public lands and excess parking); retrofitting older development with stormwater management

[20] An example of conflicting goals arises between nutrient TMDLs and the management of municipal wastewater discharges to protect shellfish harvesting areas from bacteria. Wastewater discharge outfalls have intentionally been located as far upstream away from shellfish waters as possible. This is done as a preventive measure to protect shellfish harvesting areas from contamination due to a potential treatment plant malfunction. The environmental tradeoff is that locating treatment plant outfalls upstream results in discharges of nutrients to poorly flushed tidal headwaters of limited volume (limited assimilative capacity), which increas the occurrence of algal blooms that would not occur if the discharge outfall was located in the larger part of the tidal river.

systems; and implementing impervious surface maintenance practices such as vacuuming. The amount of additional low-density land use within urban areas should be minimized.

8. **Density** – For both existing and future development areas, the most effective long-term strategy is increased density of urban development combined with permanent protection of open space. Floor area ratio (FAR) and population density can be used as indicators for assessing this strategy, and specific goals can be set to increase FAR and density. To implement this strategy, local governments should consider the physical, economic, and legal issues for achieving increased density. For example, local governments need to consider infrastructure issues such as adequate water pressure for high FAR development and fire insurance, economic issues such as financing for higher-density mixed-use development and structured parking, and legal issues such as form-based codes to encourage alternative "new urbanism" development. Local governments should work with state and federal agencies to address barriers to implementation of water-quality performance development. Other familiar urban land use alternatives such as transit-oriented development (TOD) should be encouraged to help meet existing TMDLs and to protect healthy water quality. As a further strategy, high-functioning resources such as forested areas within urban growth boundaries should not be zoned for development. That is, net density concepts, in which the same number of development units is maintained by increasing density in some places and preserving other places, should be applied.

9. **Rural Land Use Strategies** – Healthy rural "working lands" economies help preclude water quality impairments associated with urbanization, as they provide high-value economic return for the use of land. Economically viable agriculture helps prevent land conversion pressures, thus preserving open space and Maryland's rural heritage. Comprehensive planning should emphasize and support the ecosystem services of rural land (particularly forests), including regulation of watershed hydrology, protection of drinking water sources, maintenance of stable stream morphology, and even non-TMDL benefits such as maintenance of air quality[21].

   Rural development potential and environmental impact on water quality can be reduced through use of Purchase/Transfer of Development Rights (PDR and TDR), down-zoning, and clustering. These measures alone will not protect rural lands. They are much more effective when used in conjunction with incentives to concentrate growth to designated growth areas. The comprehensive plan and its implementation should encourage cooperation among existing rural "service" agencies (counties, Soil Conservation Districts, USDA Natural Resource Conservation Service, Forestry Boards, Maryland Department of Agriculture, MD Department of Natural Resources, etc.) and citizen-based watershed organizations for education of citizens about overall stewardship and provision of technical and financial assistance for specific water quality practices.

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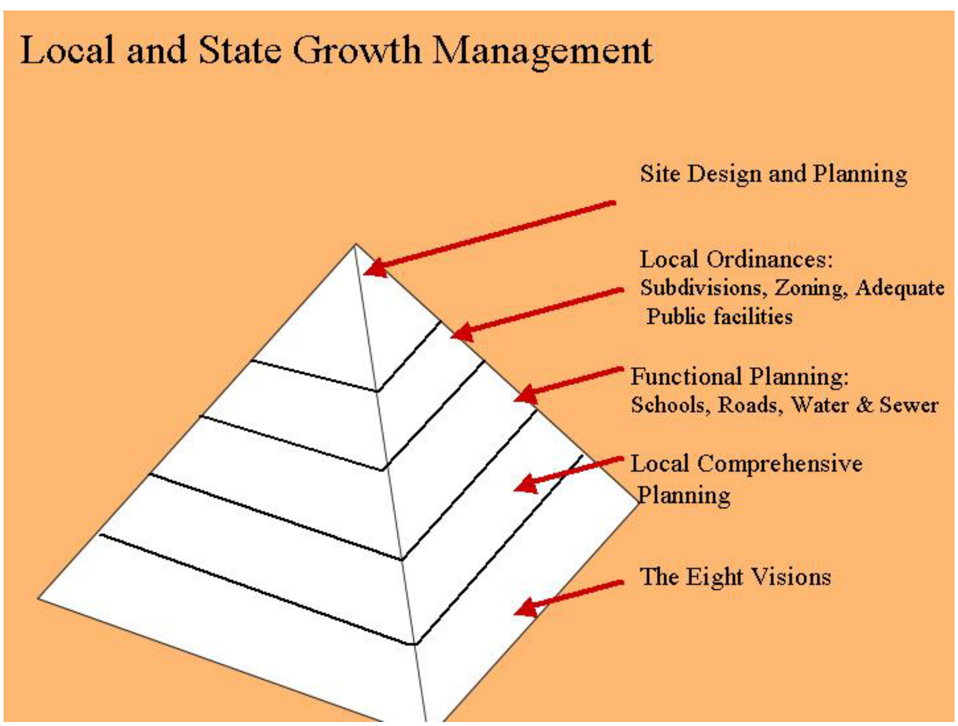
[21] The Code of Maryland Regulations, 26.08.02.01(A)(2)(c) specify that, among other things, "Water quality standards shall provide water quality for the designated uses of… Propagation of fish, other aquatic life, and wildlife," emphasis added. Although TMDLs do not set explicit goals for terrestrial wildlife, this regulation can be interpreted to include protection of balanced wildlife populations and biodiversity.

### 5.3.4 The Full Range of Land Use Planning

Meeting the challenges of TMDL implementation will necessitate use of the full range of land use planning elements portrayed graphically below. In Maryland, the full range of land use planning elements builds conceptually upon the following Eight Visions:

*(1) Development is concentrated in suitable areas;*
*(2) Sensitive areas are protected;*
*(3) In rural areas, growth is directed to existing population centers, and resource areas are protected;*
*(4) Stewardship of the Chesapeake Bay and the land is a universal ethic;*
*(5) Conservation of resources, including a reduction in resource consumption, is practiced;*
*(6) Economic growth is encouraged and regulatory mechanisms are streamlined;*
*(7) Adequate public facilities and infrastructure under the control of the county or municipal corporation are available or planned in areas where growth is to occur; and*
*(8) Funding mechanisms are addressed to achieve these visions.*

How local governments choose to use the full array of land use planning elements to meet the challenges of restoring and protecting water quality is a local decision. Although consistent practices among local governments are desirable, some aspects will vary depending on the policies adopted by different local governments. The subject of land use planning and implementation measures will be a key part of ongoing dialogue as the State and local governments refine this TMDL Implementation Guidance during the coming years.



### 5.4 Rural and Agricultural Settings

This section recognizes the need for local governments to interface with agricultural agencies. There is a potential gap in support for rural residential communities. There is also a need to ensure that water quality protection is balanced with maintaining the rural economy.

The Maryland Department of Agriculture works closely with federal agencies, the Maryland Cooperative Extension Service, and local Soil Conservation Districts (SCDs) to deliver coherent technical and financial services to farming and rural communities in support of natural resource protection. MDA is responsible for administering Maryland Agricultural Land Preservation Program and regulations of the 1998 Water Quality Improvement Act that require nutrient management plans. MDA also works closely with landowners and farm operators to address various regulatory compliance issues, such as finding remedies for erosion "hot spots" and bacteria sources. MDA is also responsible for collecting and reporting information that supports the tracking of agricultural best management practices (BMPs). This information is used to estimate progress toward achieving pollution reduction goals and the Chesapeake Bay Agreement Tributary Strategies for nutrient reduction.

The roles of SCDs vary among different local governments. The SCDs common role related to TMDL implementation is to increase voluntary conservation practices among farmers, ranchers and other land users. SCDs also assist in the development of soil conservation and water quality plans, which include best management practices (BMPs) for protecting wetlands, water quality, and preventing soil erosion. SCDs in many local jurisdictions also review soil and erosion control plans for urban development. District staff work closely with watershed residents and have valuable knowledge of local watershed practices. See the Maryland Association of Soil Conservation District web site: http://www.mascd.net/scds/MDSCD05.htm

Agricultural businesses will also have a role in TMDL implementation, not only farmers, but businesses that support farming operations. These include consultants that develop nutrient management plans, and businesses that provide inputs such as farm implements, fertilizers, pesticides and herbicides. Rural communities and non-farming businesses depend on the economic viability of the farming industry. This should be considered as part of the development of policies and procedures for protecting water quality.

## 5.5 Economic and Regulatory Incentives

Economic and regulatory incentives offer a balanced approach to environmental protection. Incentives influence the way regions, counties, municipalities, and neighborhoods grow by incentivizing certain types of practices and land use decisions. When benefits embodied in well-conceived incentives are widely known, private sector actions tend toward desired environmental outcomes. New commercial and residential buildings are proposed, planned, and built in a more environmentally sensitive way with less government intervention at each step of the way. This increases public and private sector productivity by saving time and human resources. Private profits are enhanced and the public receives more for their tax investments.

The multi-media environmental impacts of land use and transportation decisions are incremental, cumulative, and large. Growth and development can have profound effects on both water quality and quantity. Protecting our water resources becomes increasingly difficult as more woodlands, meadowlands, and wetlands disappear under impermeable cover. People are concerned about preserving the environmental quality of local rivers, lakes, and streams while continuing to develop. Local governments, working with planners, citizen groups, and developers, are thinking about where and how this new development can enhance existing neighborhoods and also protect the community's natural environment. They are identifying the characteristics of development that provide vibrant neighborhoods rich in natural and historic assets, with jobs nearby, a range of residential options, secure drinking water, functional schools and more transportation choices.

To achieve these goals, local governments are looking for, and using, policies and tools that enhance these desired characteristics. Many are attempting to direct growth to places that maintain and improve the historic appearance and infrastructure for which investments have already been made.

There is a growing consensus that traditional environmental protection systems need to be enhanced to handle an increasingly complex set of environmental challenges. The challenge posed by maintaining consistency with TMDLs to protect water quality and reverse the loss of habitat and biodiversity requires a broader set of tools than those relied upon in the past.

Public programs that educate businesses about pollution prevention (P2) are one example of an enhanced environmental program. Combined with traditional regulatory programs, drawing attention to P2 can reveal near-term and long-term financial savings inherent in changing processes (lower input cost, increased process efficiency, lower environmental management costs, and decreased legal liability).

New protection systems internalize environmental and health costs *and* benefits within the business decision framework. These can take the form of market-based programs, or requiring that activities bear the full cost of preventing any potential environmental degradation. The latter is represented by the principle of requiring new pollutant loads be offset. This can be administered by requiring actions be taken to offset new loads, or by a fee-in-lieu system that covers the full cost for the public sector to take actions that offset the new loads.

A variant on internalizing the cost of environmental protection is differential development-related fees. Although not necessarily designed to internalize the cost of environmental protection, fees can be structured to influence how or where development is conducted. For example, larger fees can be set for sewer hook-ups and plat approvals with septic systems in suburban fringe locations than for sewer hook-ups in areas of existing development. See, “Funding and Fee Structures” in “Protecting Water Resources with Smart Growth” (EPA, 2004). http://www.epa.gov/smartgrowth/pdf/waterresources_with_sg.pdf

Greater attention is also being given to cross-media efforts that leverage individual actions for multiple environmental benefits. The principle of directing land development to specific growth areas is desirable for this reason: the countryside is preserved (land); fewer miles of roadway must be paved per unit of development, resulting in less stormwater runoff (water); and average travel distances are reduced thereby reducing auto emissions (air & water - nitrogen & land when greenhouse gases are considered).

This new generation of environmental challenges is well represented by the impacts of land development and water quality protection. The many individuals and groups who exert influence on how and where communities grow are fragmented. Development outcomes are determined by a complex set of market, regulatory, institutional, and social factors. The resources needed for typical command and control approaches to environmental management are easily overwhelmed. Incentive systems are ideal for this situation.

Local land use plans help direct development to specific areas within their communities. In addition, they help plan how that development occurs. A number of tools are available to communities to encourage development practices that serve smart growth and water quality goals. In addition to regulations mandating certain types of development, incentives can help shape development practices through voluntary changes. Incentives such as density bonuses, streamlined permitting in areas where development is desired, differential fee structures, and the identification of development areas that have no pollutant offset requirements are all ways to provide development incentives. The creation of these kinds of incentives can incorporate features that balance water quality and smart growth goals.

For example, a density bonus allows a developer to construct a building at a size and scale beyond that allowed by conventional zoning, thereby offering more opportunity for profit on the same amount of land. It is typically provided to developers as a reward or incentive when they provide a public amenity, such as parks, plazas, or affordable housing.

Enhanced water quality benefits could also be included in the list of eligible public amenities. Municipalities can offer decreased development fees for developments that include features to reduce impervious cover beyond minimum requirements. Such features could include the use of living (green) roofs or landscaping that reduce runoff and treat water onsite. Bonuses or reduced fees can also be provided to developers who agree to replace older water and sewer infrastructure serving the project. This type of approach yields multiple benefits. More projects are likely to incorporate features that mitigate runoff, and increased density allows more development to occur on less land, leading to more efficient use of existing roads, sidewalks, and water/sewer systems.

As one example, the city of Portland, Oregon, was the first in the nation to offer significant private sector incentives in the form of density bonuses for developments that incorporate green roofs to reduce runoff. In 2001, with a large concentration of new development along the Willamette River, the city approved the Floor Area Ratio bonus option for developments that include the use of landscaped rooftops to retain and filter rainwater. The program offers a sliding scale of density bonuses based on the size and relative scale of the green roof; developers can earn as much as three square feet of additional floor area for each square foot of green roof area.[22]

A similar incentive framework can be created to address existing development, which could be administered through a stormwater management impact fee system. Stormwater management systems assess property owners an annual impact fee based on their contribution of stormwater. Such fees typically fund the maintenance of existing stormwater devices, and can be used to fund the restoration of streams that have been impacted by stormwater runoff. Fee structures can be designed to offer reductions to property owners for retrofitting their properties with stormwater management.

It is important, however, that the fees in question be meaningful relative to the commercial costs, otherwise a fee reduction incentive has no relevance to the business decision-making process, and merely takes on a public relations appearance. Because TMDLs create a quantified accounting framework for assessing results, inadequate fee structures are likely to be exposed in the future. In light of recent changes in Maryland real estate values, and the impending need for enhanced environmental management capacity, local reviews of existing fee structures would be advisable.

This same approach of incentivizing environmental protection can also be applied to TMDLs. Maryland intends to develop TMDL implementation plans in coordination with local governments and stakeholders. Because many elements of an implementation plan are most effectively administered at the local level, the State could offer incentives to encourage local government involvement. For example, financial incentives could be provided to communities that accelerate the adoption of necessary technical and administrative capacities to create a nutrient offset management framework. Other incentives could be provided for institutionalizing policy in formal frameworks, such as comprehensive plans, zoning plans and local subdivision regulations.

In summary, planning and regulatory requirements will continue to play a significant role in the protection of water quality. However, these traditional tools can be modernized to incorporate concepts of regulatory incentives. In addition, separate economic incentives also provide very powerful influences on positive choices by the private sector. Establishing and continually refining these kinds of incentives can dramatically improve the way traditional planning-based environmental management frameworks function. In addition, if the incentives are well-

[22] Portland Provides Incentives for Green Roof Implementation. 2001. *The Green Roof Infrastructure Monitor*. Vol 3., No. 1. www.greenroofs.ca/grhcc/GRIM-Spring2001.pdf.

designed and financially meaningful, far less government intervention will be needed to achieve the environmental outcomes that the general public desires.

### 5.5.1 Incentives References

The Green Roof Infrastructure Monitor, "Portland Provides Incentives for Green Roof Implementation," 2001, Vol 3., No. 1. www.greenroofs.ca/grhcc/GRIM-Spring2001.pdf

Northeast-Midwest Institute, "Coming Clean for Economic Development: A Resource Book on Environmental Cleanup and Economic Development Opportunities," 1996. This document addresses Brownfields issues. www.nemw.org/cmclean.htm

Richards, Lynn, US EPA Office of Policy, Economics and Innovation, made significant contributions to Section 5.5 richards.lynn@epa.gov

US EPA, "The United States Experience with Economic Incentives for Pollution Control," EPA-240-R-01-001, National Center for Environmental Economics, Office of Policy, Economics, and Innovation, Office of the Administrator, January 2001.
www.yosemite.epa.gov/ee/epa/eed.nsf/Webpages/USExperienceWithEconomicIncentives.html

US EPA "Protecting Water Resources with Smart Growth," 2004, provides 75 policy proposals, which include many incentive concepts.
www.epa.gov/smartgrowth/pdf/waterresources_with_sg.pdf

## 5.6 Case Studies

Case studies provide tangible examples of how local governments are incorporating water quality protection and restoration into their routine planning and decision-making. These examples demonstrate that “TMDL implementation” need not be defined solely in terms of “TMDL Implementation Plans,” but instead can be instituted through policy and procedure enhancements to existing programs.

### 5.6.1 Montgomery County Case Study: Using Imperviousness Studies to Guide Area Master Planning

For more than a decade, the Montgomery County Department of Parks and Planning has been using the projection of imperviousness by subwatersheds to aid in the density, parkland designations and facility decisions made in local area master plans. Using the research compiled by the Center for Watershed Protection and our own statistical analyses, planning for good quality Use III and IV streams strives for ultimate imperviousness near or below 10%.

These projections are developed using the baseline imperviousness derived from planimetric information (from aerial photography at 1”=200’). Prior to undertaking a master plan, a study of recently approved subdivisions is conducted to determine how much typical imperviousness (on a per acre basis) is associated with different zoning categories that might be used in the master plan. Then the planning team identifies properties that are vacant and redevelopable, and the imperviousness factors are substituted for the existing imperviousness on those parcels. The results are then totaled by subwatershed and accumulated for downstream subwatersheds. This is repeated for as many different scenarios as the process requires. Initially, these calculations are used to identify a range of environmentally acceptable alternatives that meet as many of the other desired goals for the area as possible. If other goals, such as development in priority funding areas, are determined to take precedence, then the calculations are used to determine the potential impacts of various alternatives.

The projected imperviousness findings are compared to the existing imperviousness and stream conditions found in each subwatershed and a finding made as to whether stream conditions appropriate to the Use designation will be maintained. This is done using a water quality regression model utilizing imperviousness to estimate future impacts on the benthic macroinvertebrate and fish communities. The health of the existing benthic and fish communities is measured using monitoring data that are combined into a composite score. Using the modeling results for various buildout scenarios, zoning and density adjustments to existing zoning are recommended, where feasible, to help maintain high quality waters, particularly Use III and IV streams.

Most of the master plan areas studied in the last decade had a substantial amount of existing development with many subwatersheds already at 8-11% imperviousness. In the Use III and IV streams, the primary means of protection has been the use of a low-density tight cluster zone that results in less than 8% imperviousness for new development. Depending on the amount of existing development, the resulting projected ultimate subwatershed imperviousness has ranged from 10-13% imperviousness. This then allows some additional “cushion” for the normal expansion of existing development, public facilities, institutions and other uses that may need to be accommodated over the 15-20 year lifespan of the master plan.

### 5.6.2 Worcester County Case Study: Using Nutrient TMDLs to Guide Comprehensive Land Use Planning

Worcester County is home to Maryland's Coastal Bays, which are very shallow sensitive embayments created by narrow barrier islands that separate the bays from the Atlantic Ocean. It is also one of the first jurisdictions in Maryland to make a conscious link between nutrient TMDLs and Comprehensive Landuse Planning.

The Worcester County Commissioners were briefed on the draft Comprehensive Land Use Plan during their September 20, 2005 meeting. According to records of the meeting, the County Planning Director stated that, "the overall objective of the Comprehensive Plan is to preserve the rural/coastal character of Worcester County." This objective reflects the need to balance the growth pressures with protection of the desirable characteristics that attract people to the coastal area of Worcester County.

At that meeting, the Planning Commission Chair, Carolyn Cummins, stated that, "the County's population is projected to grow by roughly 18,000 year-round residents over the next 15 to 20 years, and the plan proposes providing about 3,700 acres of new growth to accommodate that population." She also noted that one of the four "primary concerns" of area residents who participated in the process of creating the plan was that "growth areas needed to proactively address Total Maximum Daily Load implementation to protect our waterways."

The County Director of Environmental Programs, which serves the function of the Health Department in many other counties, also cited the TMDL in his remarks. He indicated that the Comprehensive Plan recommends an existing development, currently served by septic systems, should be connected to a sewer system. He explained that doing so would reduce nutrient loads. He also cited nutrient TMDLs when recommending sewer connections, rather than septic systems, for several future developments.

The proximity of the County to this special waterbody, and its dependence on tourism, explains in part why the TMDL is playing a role in the comprehensive planning process. Maryland's Coastal Bays Program, which guides the restoration and protection of this resource, also played a role by raising public awareness about TMDLs in a "Special Comp Plan Edition" of their "Solutions" newsletter mailed to every resident in the watershed. In a more general way, The Coastal Bay Program set the foundation by leading development of the Comprehensive Conservation Management Plan (CCMP), which calls for the development of subwatershed plans.

Within the context of developing subwatershed plans, the County invested time and staff resources into quantified TMDL implementation analysis for the Coastal Bay nutrient TMDLs. As a result, Worcester County is one of the first counties in Maryland to begin incorporating quantified TMDL implementation analyses into their planning process.

The process began in 2004, as Worcester County worked with State agency staff to conduct a preliminary nonpoint source reduction analysis for Newport Bay. The goals of the project were limited to conducting a sensitivity analysis designed to assess the upper and lower bounds on what could be achieved through nonpoint source reductions. The sensitivity analysis considered two types of uncertainty: 1) uncertainty in the areas where BMPs could be implemented, for example, how many miles of forested buffers could be planted, and 2) uncertainty in the reductions that could be achieved by various types of BMPs, for example, assuming that the percentage reduction of a particular BMP might range from 25% to 40%. The quantitative result of the analysis was expressed as a range of potential nonpoint source load reduction. The practical result was the revelation that achieving the nonpoint source reductions would be very challenging. This insight prompted local officials to ponder the value of various programmatic tools, such as transfer of development rights and the County forest-banking ordinance, which is on the books but was inactive.

The insights from the analysis also informed the planning staff in a general way as they developed the Comprehensive Land Use Plan. In early 2006, Worcester County will refine the nonpoint source analyses to guide several specific planning questions. One question relates to the need to reallocate nutrients that were originally provided to two industrial point sources that have ceased operations. Another questions is whether or not some of the point source allocation should be reallocated to offset a potential shortfall in achieving the nonpoint source goals. An alternative to this would be to redirect some of the current point source effluent to spray irrigation. Consideration of this option would influence land use decisions regarding the preservation of land for this purpose.

The value of incorporating the nutrient TMDLs into local land use planning is evident from the experiences of Worcester County. The judicious consideration of alternatives from the broad perspective of land use planning will help optimize the consumption of the limited nutrient allocations. This will help preserve future development potential while simultaneously achieving required water quality goals.

## 5.7 Capacity Building

The procedures for TMDL implementation are evolving rapidly. New technical and administrative capacity will be needed to manage water quality in a more sophisticated way. The needs will include the collection and management of new information, the analysis of that information for making new decisions, and the administration of these new activities.

Specifically, these enhanced capacities include the ability to conduct land use planning in a way that minimizes the consumption of limited pollutant load allocations. To do this, it will be necessary to evaluate changes in pollutant loads due to land use changes and pollution control actions. It will also be necessary to ensure that any future load increases are evaluated and offset by pollution reductions, while also striving to gradually reduce existing excessive pollutant loads.

These enhanced technical capacities will in turn require enhanced financial capacities. Local governments are urged to consider new or enhanced financing systems and revenue sources. Ideally, these will be conceived in a way that creates incentives for the private sector to protect water resources (See Section 5.5 "Economic and Regulatory Incentives").

Failure of State and local government to build these capacities could leave future development projects vulnerable to third party legal challenges on the grounds that they are inconsistent with TMDLs and related provisions of federal law. Having enhanced capacity at the local level will help to ensure future flexibility, maintain local control, seize on opportunities, and maximize fiscal and administrative efficiency. This will enable a smooth transition and will benefit those who depend on government services by avoiding confusion and delays. Recognizing how much is at stake, the State will lead a joint initiative with local governments to build the capacity needed to meet this challenge.

### 5.8 Multi-Jurisdictional Coordination

One of the more challenging TMDL implementation issues is the future management of pollutant allocations. That is, how can allocations be re-distributed over time in a transparent and equitable way? This subject is further complicated when multiple jurisdictions are involved. This section begins to shed light on this and other topics.

#### 5.8.1 Basic Principles

Maintaining Local Control: The desire to maintain local control over decisions is a basic principle whether that local control is of a State relative to the federal government, or local jurisdictions relative to the State. When complex decisions regarding water quality arise among states, it is ideal for the affected states to resolve the issue without forfeiture of control to federal authorities. The same can be assumed among local jurisdictions.

The State urges local governments to take proactive steps to maximize local control over future water quality decision-making. First, heed the recommendation to identify a TMDL coordinating committee described in Section 3.4.1 of this Guidance. Begin familiarizing yourself with the many emerging TMDL implementation issues.

Second, identify inter-jurisdictional challenges. Begin engaging neighboring jurisdictions on these issues through your TMDL coordinating committee framework.

Finally, solicit early State facilitation of inter-jurisdictional dialogue on complex TMDL implementation issues. Failure to bring the State in early could result in time-sensitive decisions being made in a crisis mode, which is likely to result in less than ideal outcomes.

Golden Rule of Upstream and Downstream Cooperation: Most jurisdictions are both upstream and downstream of other jurisdictions. The principle of "do unto others as you would have others do unto you" takes on relevance in the context of upstream and downstream water quality relationships. This recognition promotes goodwill when considering actions, or inaction, that might affect downstream neighbors.

Legal Considerations: Ideally, the "Golden Rule" of upstream and downstream cooperation will suffice to ensure that upstream jurisdictions respect their downstream neighbors. However, failing that, upstream jurisdictions can be held responsible for protecting downstream water quality (40CFR Part 131.10(b)). TMDLs can play a role in clarifying these matters.

#### 5.8.2 Issues to Consider

Formal and Informal Public Involvement: The federal Clean Water Act includes legal requirements for public involvement at various stages of the water quality management process. These stages include the establishment and revision of water quality standards, the identification of impaired waters on the State 303(d) list, the adoption of a TMDL, the issuance of permits in conformity with TMDLs, and the redistribution of pollutant allocations between point source and nonpoint source categories, and between political jurisdictions.

In multi-jurisdictional situations, the formal public involvement process must include proper notification of all jurisdictions. This implies the potential need to include public notices in multiple news sources, particularly in multi-state circumstances.

Land use planning: Ideally, TMDL implementation planning should be incorporated into the land use planning process so that competing needs may be weighed as part of a unified process. Including water quality planning at an early stage also helps to avoid missed opportunities. It also helps avoid the more difficult and costly regulatory decision-making processes that result from addressing the issues too late in the planning sequence. Given that water quality planning often necessitates a multi-jurisdictional approach, it stands to reason that land use planning should also be conducted as a multi-jurisdictional undertaking.

Allocations and Upstream and Downstream Considerations: TMDL analyses include technical information that clarifies the responsibilities among jurisdictions. This can take several forms. For low flow conditions, some TMDLs place an upper threshold on the upstream concentration of pollutants, which is reflected in technical support information (e.g., in model input files for TMDL scenarios). This pollutant concentration information, in combination with flow information, can be interpreted to imply a low-flow loading limit or geographical allocation. However, because nonpoint source management is generally assessed on an average annual basis, allocations of annual loads among jurisdictions are typically more useful.

Logic similar to that applied to the low-flow condition could be used to estimate an inter-jurisdictional allocation for the case of average annual loads. That is, average annual upstream concentrations and flows used in the TMDL modeling scenario can be used to deduce load allocations among jurisdictions. However, the use of land use information combined with typical unit area loading rates might be an easier approach.

For instance, pollutant loads associated with land cover that was present at the time the TMDL was developed could serve as a guide for partitioning loads among local jurisdictions. The load reductions needed to meet the TMDL could be estimated under the assumption of uniform implementation of BMPs that are commonly used on each type of land use. This would result in projected pollutant reductions that are proportional to the land use in each jurisdiction (areas with a large proportion of forest would be expected to reduce less than areas with greater areas of agriculture and urban land). The resultant loads, after the reduction calculations, would constitute an allocation among various jurisdictions. This type of approach could serve as an equitable means of allocating the TMDL among the jurisdictions in cases where the TMDL analysis does not do so. Variants of this general concept could also be used to arrive at fair allocations.

Some TMDL analyses partition the TMDL among subwatersheds. This allocation might be reflected in the technical memoranda or deduced from the technical support materials (e.g., TMDL modeling input files). To the degree that the subwatersheds are divided among separate jurisdictions, this information can be used as a guide for partitioning loads.

TMDLs that include regulated stormwater waste load allocations for compliance under NPDES stormwater permits specify a partitioning of the loads in a technical memorandum to the TMDL document. Note that, although these allocations are identified in tables under MS4 permit numbers, they include municipal, State Highway and industrial loads within the given jurisdictions, including a factor for loads associated with construction activities. These allocations are aggregated because currently there is insufficient information upon which to base disaggregated allocations.

### 5.8.3 Contacts

Multi-jurisdictional depends on routine communications among key stakeholders. The following contacts will help in that regard.

Baltimore Metropolitan Council of Governments (BMC)
2700 Lighthouse Point East
Suite 310
Baltimore, MD 21224-4774
(410) 732-0500 (contact: Gould Charshee)
http://www.baltometro.org/index.asp

EPA Chesapeake Bay Program Office
410 Severn Avenue - Suite 109
Annapolis City Marina
Annapolis, MD 21403
1-800-YOURBAY
http://www.epa.gov/region03/chesapeake/index.htm

EPA Region III
1650 Arch Street
Philadelphia, PA 19103
1-800-438-2474
http://www.epa.gov/region03/index.htm

Interstate Commission on the Potomac River Basin (ICPRB)
51 Monroe Street, Suite PE-08
Rockville, MD 20850
(301) 984-1908
info@icprb.org
http://www.potomacriver.org/

Maryland Association of Counties (MACO)
169 Conduit Street
Annapolis, MD 21401
(410) 269-0043 (contact: Leslie Knapp)
http://www.mdcounties.org/

Maryland Coastal Bays Program
9609 Stephen Decatur Highway
Berlin, MD 21811
(410) 213-2297 (contact: Carol Cain)
http://www.mdcoastalbays.org/

Maryland Department of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401
(410) 841-5896 (contact John Rhoderick)
rhoderjc@mda.state.md.us

Maryland Department of Environment
1800 Washington Blvd., Suite 540
Baltimore, MD 21230-1718
(410) 537-3902 (contact Jim George)
jgeorge@mde.state.md.us

Maryland Department of Natural Resources
Tawes State Office Building, D2
Annapolis, MD 21401
(260) 260-8630 (contact Sherm Garrison)
sgarrison@dnr.state.md.us

Maryland Department of Planning
301 W. Preston St.
Baltimore, MD 21201-2365
(410) 767-4560 (contact Rich Hall)
rhall@mdp.state.md.us

Maryland Municipal League (MML)
1212 West St.
Annapolis, MD 21401
(410) 268-5514 (contact: James Peck)
http://www.mdmunicipal.org/

Metropolitan Washington Council of Governments (MWCOG), Suite 300
777 North Capitol Street, NE
Washington, DC 20002
(202) 962-3200 (contact: Ted Graham)
http://www.mwcog.org/

Susquehanna River Basin Commission (SRBC)
1721 N. Front Street
Harrisburg, PA 17102
(717) 238-0423
srbc@srbc.net
http://www.srbc.net/

Tri-County Council of Southern Maryland
PO Box 745
15045 Burnt Store Road
(301) 274 – 1922
www.tccsmd.org/
http://www.tccsmd.org/web/t/indext.html

Tri-County Council of Western Maryland
113 Baltimore Street, Suite 300
Cumberland, MD 21502
(301) 777-2158 (contact: Leanne Mazer)
http://www.tccwmd.org/

**Other States**

Delaware DNREC
Division of Water Resources
Watershed Assessment Section
820 Silver Lake Boulevard, Suite 220
Dover, DE 19904-2464
302-739-4590 (contact: John Schneider)
john.schneider@state.de.us
http://delaware.gov/

Pennsylvania DEP
Rachel Carson State Office Building
400 Market Street
Harrisburg, Pennsylvania 17105
(717) 787-2814 (contact: Glen Rider)
grider@state.pa.us
http://www.dep.state.pa.us/

Virginia DEQ
629 East Main Street
Richmond, Va. 23219
(804) 698-4000 (contact: Charles Martin)
http://www.deq.state.va.us/

West Virginia DEP
601 57th St. S.E.
Charleston, WV 25304
(304) 926-0495 (contact: Jennifer Pauer)
http://www.dep.state.wv.us/

**Other Local Governments**

See Appendix H "Maryland Local Government TMDL Primary Contacts"

**Federal Agencies**

See Section 3.5.1